

EFFECT OF FUNCTIONAL GROUPS AND IONIZATION ON THE RADICAL COPOLYMERIZATION OF ACRYLIC ACID AND CATIONIC MONOMERS IN AQUEOUS SOLUTION

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Keywords: Aqueous-phase radical polymerization, water-soluble polymers, in-situ NMR, cationic monomers, polyelectrolytes.

The use of specialized experimental techniques has been instrumental in developing an improved understanding of aqueous-phase radical polymerization kinetics of industrially relevant water-soluble polymers. In-situ NMR technique allows for reliable data collection at monomer concentrations up to 40 wt%, following both overall monomer conversions as well as composition drift in a copolymerization system.

Our work focuses on the kinetics of [2-(methacryloyloxy)ethyl]trimethylammonium chloride (TMAEMC) and 3-(methacryloylamino)propyl]trimethylammonium chloride (MAPTAC), cationic monomers containing an ester and amide functional groups, respectively, copolymerized with both non-ionized (AA) and fully-ionized (NaA) acrylic acid to form copolymers with applications as cationic flocculating agents in water treatment. The drift in monomer composition was found to be almost entirely independent of AA ionization for both TMAEMC and MAPTAC systems, with the cationic monomers preferentially incorporated when copolymerized with AA and NaA up to 80% and 50% molar fraction of TMAEMC and MAPTAC, respectively, (as shown in Fig. 1). Above these compositions, AA (or NaA) was preferentially incorporated, with the azeotrope behaviour dependent on the total monomer concentration in the aqueous solution. The differences in copolymerization behaviour could be attributed to the influence of the functional groups on hydrogen bonding in the aqueous phase. In addition, the apparent system reactivity ratios in both systems were found to be influenced by electrostatic interactions, and thus both initial monomer content and composition.

A model to capture the copolymerization behaviour of AA-TMAEMC has been successfully completed, with efforts to measure the characteristics of the evolving polyelectrolyte solutions as a function of conversion underway in order to develop a deeper understanding of the complex system.

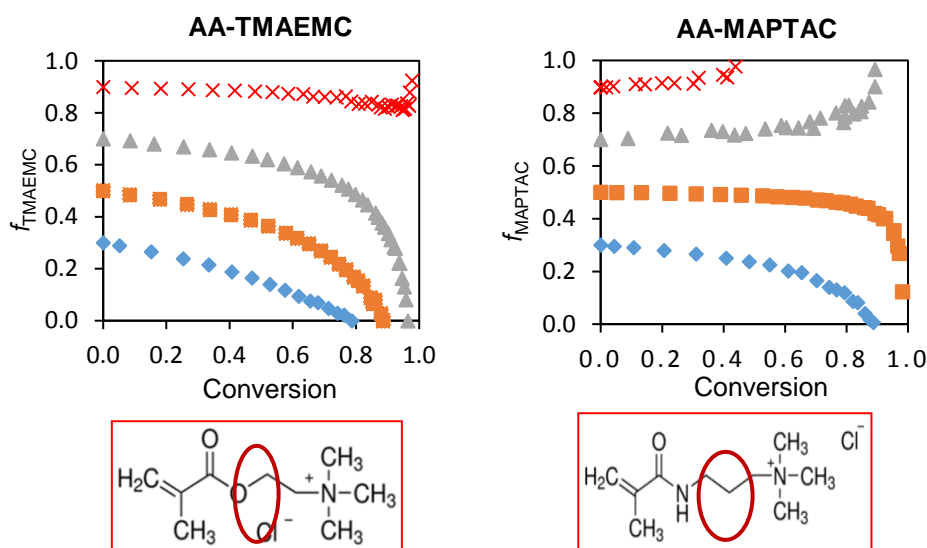


Figure 1: Comonomer composition drifts in batch copolymerizations of non-ionized AA with TMAEMC (left) and MAPTAC (right) at 50°C and 0.4 wt. % V-50, 10 wt. % monomer in aqueous solutions at different initial monomer compositions.